GIS ANALYSIS FOR THE STUDY OF RURAL DEPOPULATION: THE KINGDOM OF VALENCIA (TOMAS LOPEZ 1789)

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One of the more aspects that have shaped the landscape is the human impact. The human impact has the clearest indicator of the density of settlements in a particular geographic region. In this paper we study all settlements shown on the map of the Kingdom of Valencia, Spain Geographic Atlas (AGE) of Tomas Lopez (1788), and their correspondence with the current ones. To meet this goal we have developed a specific methodology, the systematic study of all existing settlements in historical cartography. This will determine which have disappeared and which have been renamed. The material used has been the historical cartography of Tomas Lopez, part of the AGE (1789), the Kingdom of Valencia (1789), sheets numbers (78, 79, 80 and 81); Current mapping of the provinces of Alicante, Valencia, Castellon, Teruel, Tattagona and Cuenca; As main software ArcGis V.9.3. The steps followed in the methodology are as follows: 1. Check the scale of the maps. Analyze the possible use of a spherical earth model. 2. Geo-reference of maps with latitude and longitude framework. Move the historical longitude origin to the origin longitude of modern cartography. 3 Digitize of all population settlements or cities. 4 Identify historic settlements or cities corresponding with current ones. 5. If the maps have the same orientation and scale, replace the coordinate transformation of historical settlements with a new one, by a translation in latitude and longitude equal to the calculated mean value of all ancient map points corresponding to the new. 6. Calculation of absolute accuracy of the two maps, i.e. the linear distance between the points of both maps. 7 draw in the GIS, the settlements without correspondence, in the current coordinates, and with a circle of mean error of the sheet, in order to locate their current location. If there are actual settlements exist within this circle, they are candidates to be the searched settlements. We analyzed more than 2000 settlements represented in the Atlas of Tomas Lopez of the Kingdom of Valencia (1789), of which almost 14.5% have no correspondence with the existing settlements. The rural landscape evolution of the Valencia, oldest kingdom of Valencia, one can say that can be severely affected by the anthropization suffered in the period from 1789 to the present, since 70% of existing settlements actually have appeared after Tomas Lopez´s cartography, dated on 1789.

Key words: Anthropization, Historical cartography, GIS, Valencia, Tomas Lopez.

1. Introduction

1.1. Brief review of the landscape and land occupation

The human and ecological characters of the Valencian mountain landscapes are, above all, the characteristic of the Mediterranean mountains (Rodriguez, 2011). This landlocked deserves consideration in relation to human and agricultural traits. The proper understanding of rural life in the mountains should not be based only on the potential ecological variations but it has to look carefully at the history of the landscapes and the development of lifestyles that define the conditions of man's adaptation to the environment (Defontaines, 1972).

The process of rural abandonment is widespread in Spain until the 50 and 60 of the twentieth century, coinciding with the crisis of the world derived from a Spanish rural industrialization process. In the mountainous areas is more profound than in other agricultural environments, because it breaks definitively with balances that supported traditional systems. The accumulation of facts in a short time is difficult to control in a society so dependent on agriculture led to the abandonment and ruin the landscape of much of rural Spain (Rodriguez, 2011).

1.2 Brief review of the use of historical mapping

Historical maps are an important part of our cultural heritage (Jenny & Hurni, 2011). More than mere physical artefacts, they are also a potential source of information for the studies of historians and geographers, who increasingly use maps as sources of geographical information used, for example, to trace the evolution of landscapes (Gregory & Ell, 2007; Knowles, 2002; Knowles, 2008), geo-environmental analysis (Cremonini & Samonati, 2009) or the incorporation of historical data into GIS (Weir, 1997).

1.3 AGE (Atlas Geografico de España) of Tomas Lopez 1789: The kingdom of Valencia

One of the first cartographic representations of Kingdom Valencia was made by the cartographer Tomás López de Vargas y Machuca (1731-1802). This representation was included as pages 78-79-80-81 of the The Geographic Atlas of Spain of 1804 (AGE).

Lopez´s method - learned from his teacher D´Anville, who in turn learned it from F. Chevalier (Manzano-Agugliaro et al., 2005) - has been called “studio cartography” (San-Antonio-Gomez et al., 2011). Several works described the accuracy of tomas Lopez´s method (Manzano-Agugliaro et al. 2012). See Fig. 1.

1.4. Objectives

The main objective of this study is to assess whether there has been depopulation since the Tomas Lopez cartography in 1788, or in stead this, what has existed is an increase of population settlements since then.

2. Methodology

According to Manzano-Agugliaro et al. (2012), application of GIS in assessing of early maps can be divided into several steps:

- The first step is to identify locations of the points and features of an early map on a modern base map, i.e., to find strictly comparable points and features between the early map and the modern base map. This modern base map with the identified points and features is used as the reference map to evaluate the accuracy of the early map.

- The second step is to digitize the original early paper map into GIS. Fig 2.

-The digitized early map is overlaid with the modern base map. This step was made in excel sheet by place name.

After this we have four sets of places: 1º TL (Tomas Lopez settlements) with corresponding with actual ones, 2º TL (Tomas Lopez settlements) without corresponding with actual ones, 3º Actual ones without corresponding with TL. 4º The current settlements have been subtracted in the GIS to the existing settlements TL, in order to check current anthropization. It have been deleted current settlements whose land surface is less than 1.5 ha.

The software used in our work is ArcGIS 9 v.3 (Esri, 2011).

3. Data

The material used has been the historical cartography of Tomas Lopez, part of the AGE (1789), the Kingdom of Valencia (1789), sheets numbers (78, 79, 80 and 81), and the current mapping of the provinces of Alicante, Valencia, Castellon, Teruel, Tarragona and Cuenca.

The maps have a geo-referencing frame with a graduation of five-minute intervals, in both longitude and latitude. The origin of the longitude has two references: on one extreme, the Peak of Teide, and on the opposite extreme, Madrid. Because each page was designed using a frame of graduated geographical coordinates of latitude and longitude, it is possible to geo-reference it in space using a GIS. The margins of the maps contain the representation of the graphic scale, expressed in 20 leagues per degree; Spanish geographical leagues and Castilian legal leagues.

4. Results

Table 1 shows the results of our analyses and shows that 85% of TL settlements have correspondence with the current. Fig. 1 shows the spatial distribution of these settlements where the blue settlements are the existing from Tomas Lopez cartography that have corresponding with currents. In red are settlements are the existing from Tomas Lopez cartography that have not corresponding with currents. It may be noted that where more settlements disappear, is precisely where there is more concentration of these. One might say that is a small settlement concentration phenomenon. The whole coast of the kingdom of Valencia, within 5 km of the coast, only 7 settlements are lost since TL cartography.

Fig. 2 shows a detailed of TL´s settlements lost. It may be noted that where more settlements disappear, is precisely where there is more concentration of these.

Fig. 3 shows the current settlements that have appeared after TL. Highlights the large number of settlements that have appeared. 70% of existing settlements have appeared after the TL´s cartography. The new settlements distribution by current provinces are: Alicante (293), Valencia (309) and Castellon (477).

Fig. 4 shows a the province of Castellon with the current settlements that have appeared after TL´s cartography. It looks like certain areas the density of settlements is highly concentrated.

TABLE 1: Results of Anthropization for Kingdom of Valencia (1789 to present).

Sheet number	TL existing actually		TL not existing actually		Current (not exit TL)	
	N	%	N	%	N	%
78	236	90	27	10		
79	15	100	0	0		
80	196	79	53	21		
81	11	100	0	0		
Total	**458**	**85**	**80**	**15**	**1079**	**70**

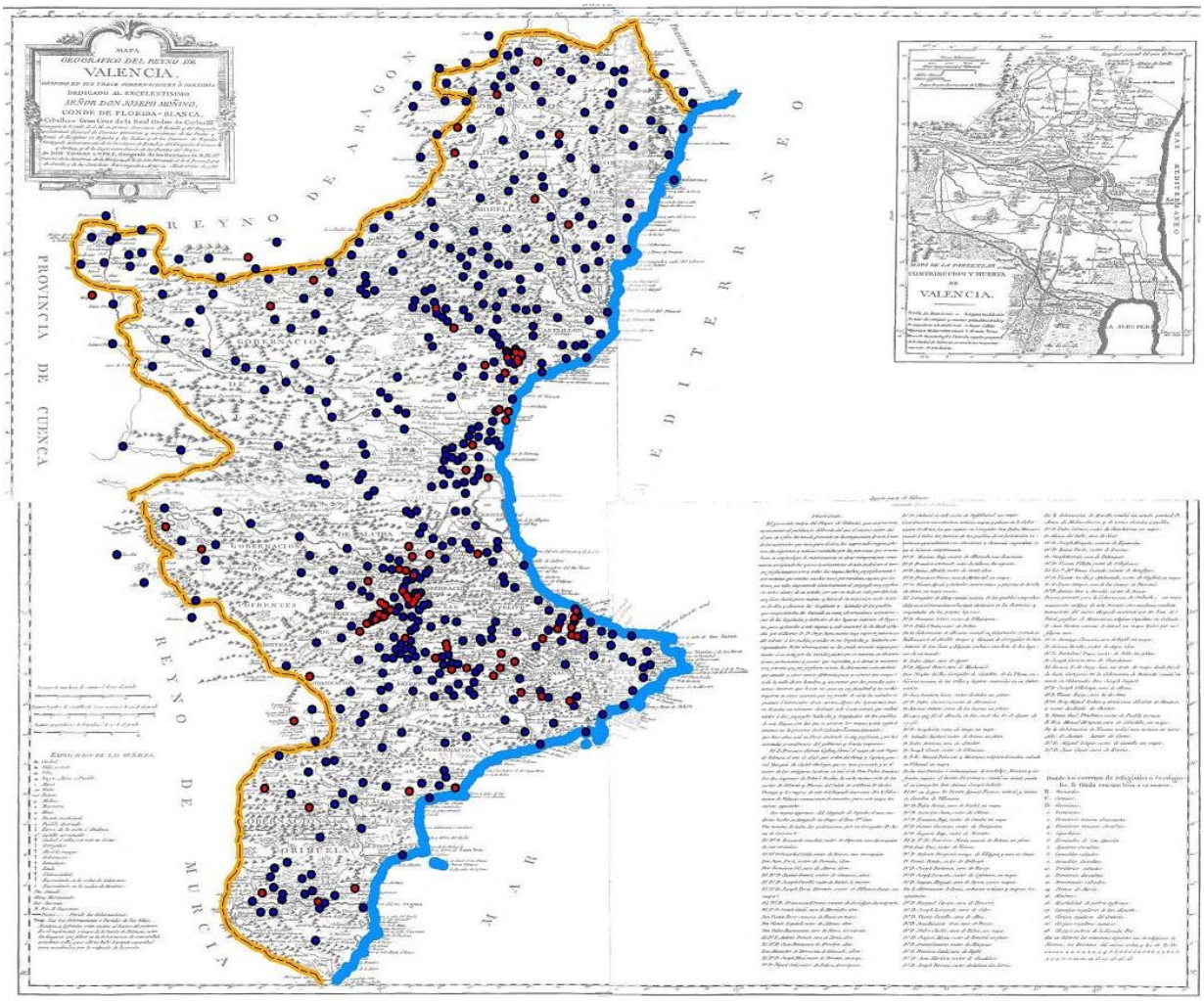

FIGURE 1: Kingdom of Valencia

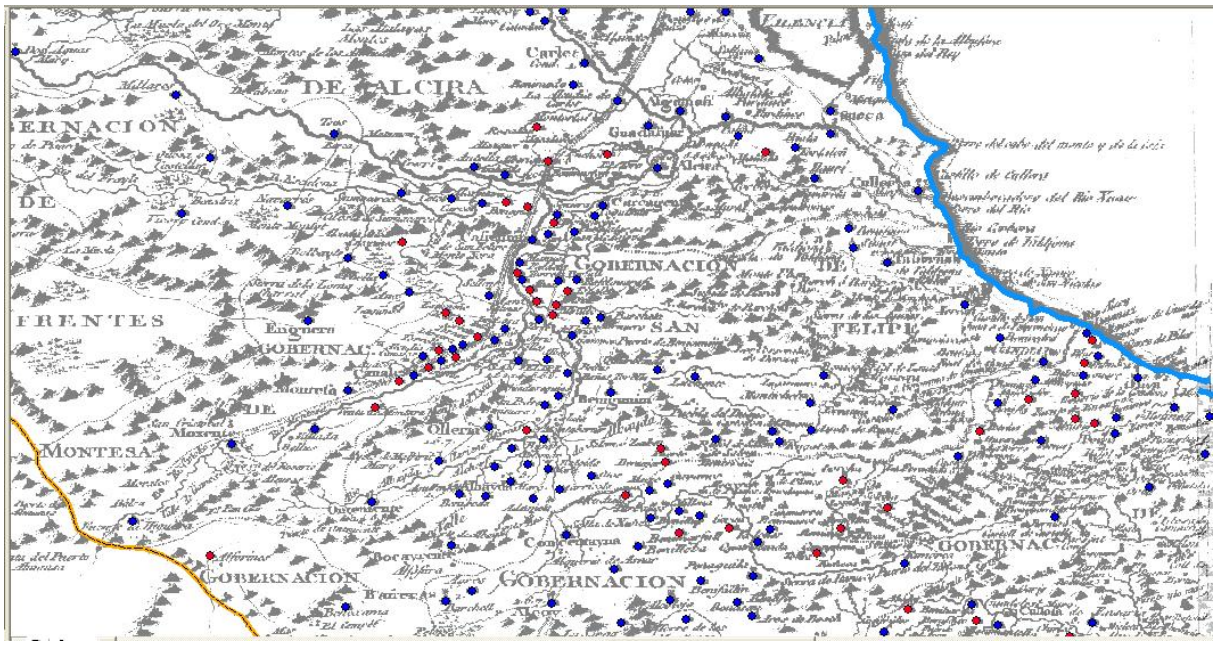

FIGURE 2: Details of settlements lost TL

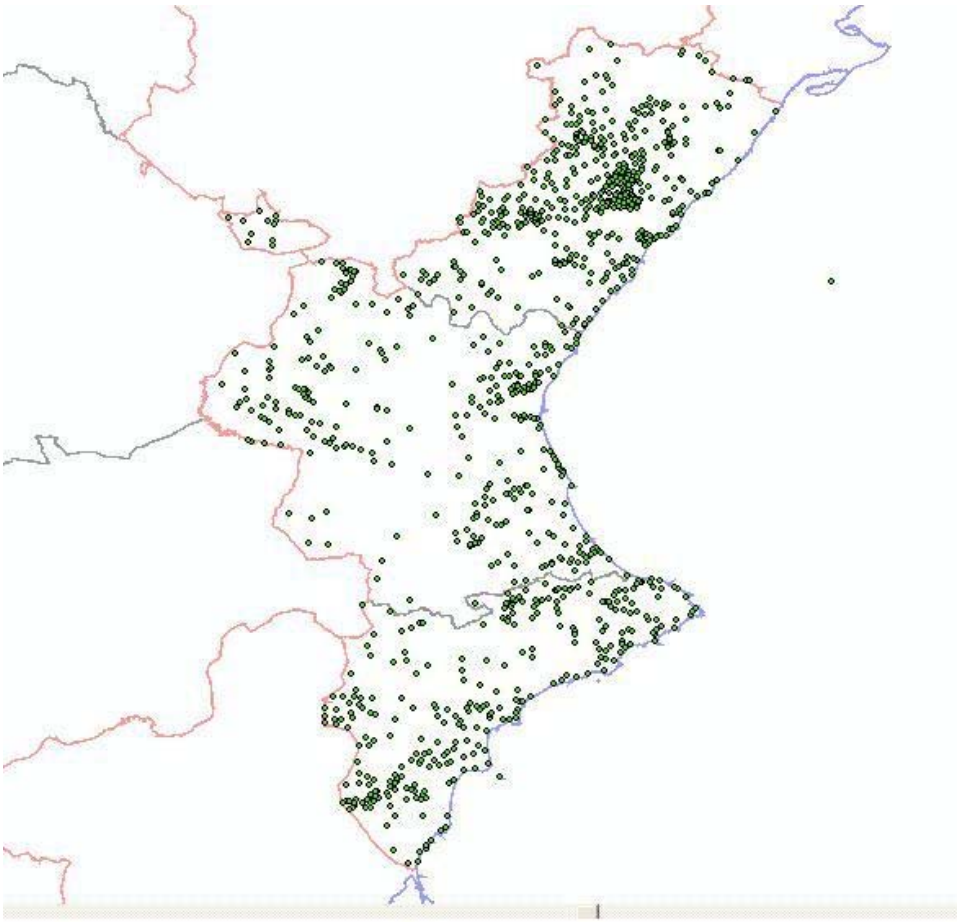

FIGURE 3: Current settlements that have appeared after TL´s cartography.

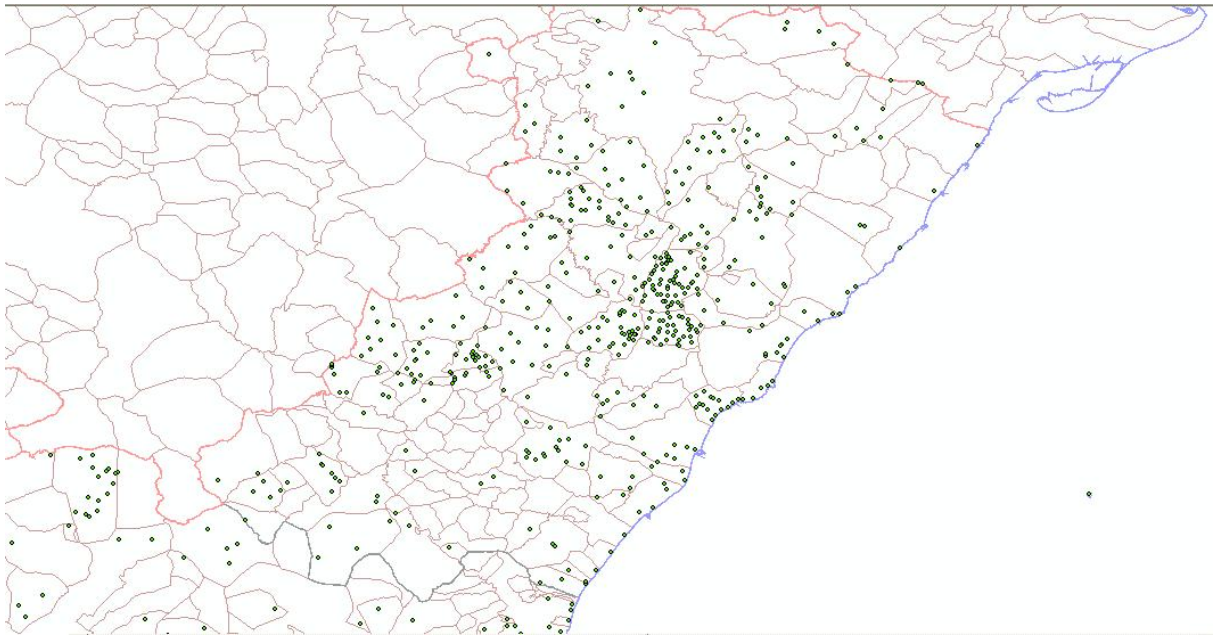

FIGURE 4: Details Current settlements that have appeared after TL´s cartography (Castellon)

4. Conclusions

The main conclusions of this paper are:

1º Can not say that there is abandonment of marginal rural areas, then disappear settlements where there is more concentration of these. It is a phenomenon of urban concentration.

2º Of existing settlements in 1789, disappear only 14.5% compared to current, and of these only 1% could be described as coastal settlements (<5 km from the coastline).

3º The rural landscape evolution of the Valencia, oldest kingdom of Valencia, one can say that can be severely affected by the anthropization suffered in the period from 1789 to the present, since 70% of existing settlements actually have appeared after Tomas Lopez´s cartography, dated on 1789.

Reference list

Defontaines P. (1972). El mediterraneo (la tierra, el mar, los hombres). (2ª ed) Barcelona: Juventud, pp 320.

ESRI (2011). [Available on-line, visited October 2011] http://www.esri.com/software/arcgis/index.html

Gregory IN, Ell PS (2007). Historical GIS: technologies, methodologies, and scholarship, Cambridge University Press, Cambridge.

Jenny B, Hurni L (2011). Studying cartographic heritage: Analysis and visualization of geometric distortions. Computers and Graphics, 35 (2): 402-411.

Knowles AK (2002). Past time, past place: GIS for history, ESRI Press, Redlands.

Knowles AK (2008). Placing history: how maps, spatial data, and GIS are changing historical scholarship, ESRI Press, Redlands.

Manzano Agugliaro F., Martinez Garcia, J, San Antonio Gómez, C. (2012). GIS Analysis of The Accuracy of Tomas Lopez´s Historical Cartography in The Canary Islands (1742 - 1746). Scientific Research and Essays 7(2):199-210

Manzano-Agugliaro F, San Antonio Gómez C, Manzano Agugliaro G (2005) El levantamiento topográfico y la cartografía en el siglo XVIII: el método de la topografía eclesiástica. In XVII Congreso Internacional INGEGRAF- ADM. Sevilla, 1-11.

Rodriguez Martínez, F. (2011) La crisis demográfica en las montañas andaluzas. Aspectos historicos y actuales. In García Lorca A, & Matarín Guil A.S. (Es.). El desarrollo rural frente al despoblamiento de los pequeños municipios. Almeria. Editorial Universidad de Almería.

San-Antonio-Gómez C, Velilla C, Manzano-Agugliaro F (2011). Tomas Lopez's geographic atlas of Spain in the Peninsular war: A methodology for determining errors. Survey Review, 43(319), 30-44.

Weir MJC (1997). A century of forest management mapping. Cartographic Journal, 34(1): 5-12.